#18 Hearing 08/29/01

Docket No. 49658-0025 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of		
MARTIN LIVESEY		
Serial No.: 09/183,621		Group Art Unit: 2672
Filed: October 30, 1998		Examiner: Chante' Harrison
For: APERIODIC TILING OF TEXTURED IMAGES		

APPEAL BRIEF

Hon. Commissioner of Patents
Washington, D.C. 20231

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed June 20, 2001.

I. REAL PARTY IN INTEREST

Autodesk, Inc., is the real party in interest.

II. RELATED APPEALS AND INTERFERENCES

Appellants are unaware of any related appeals and interferences.

III. STATUS OF CLAIMS

Claims 1-20 are pending in the application.

Claims 1-20 have been finally rejected in the Final Office Action mailed December 20, 2000. Specifically, Claims 1-5, 7-13 and 15-20 have been rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 5,956,043 issued to Jensen ("*Jensen*"). Claims 6 and 14 have been rejected under 35 U.S.C. § 103(a) as allegedly unpatentable over *Jensen* as applied to claims 1 and 8 and further in view of U.S. Patent No. 5,226,175 issued to Deutsch et al. ("*Deutsch*"). It is from these final rejections of Claims 1-20 that this Appeal is taken.

IV. STATUS OF AMENDMENTS

The claims have not been amended after the Final Office Action.

V. SUMMARY OF THE INVENTION

The present invention is a significant advance in the field of graphical imaging involving the tiling of textured images to cover textured regions. For example, a particular architectural design application may require that a large area of grass be displayed for a particular landscaping layout. A process known as texture mapping may be used to apply texture to a region, or "target area," by creating tiles from a texture image. After the textured tiles have been generated, non-overlapping copies of the tiles are applied to the target area in a way that covers the target area. (Application, page 1, lines 16-19).

FIG. 1 illustrates a tile 102 depicting a grass texture that can be used to cover a particular surface for simulating an area of grass. In this example, a single rectangular tile 102 was generated from a texture image. FIG. 2B illustrates a target area 200 covered with copies of tile 102 in a grid-like tiling pattern. The grid-like tiling pattern used to cover target area 200 with copies of tile 102 is an example of the type of periodic tiling patterns used by conventional texture mapping methods. (Application, page 2, lines 14-19).

A drawback with using conventional texture mapping methods is that the translational symmetry of the tiling patterns cause certain displacements, called "periods", to be formed. These periods are like repeating puzzle pieces that form repeating sub-patterns that are easily detected over the target area. For example, as observed in FIG. 2B, applying tile 102 to target area 200 using a periodic tiling pattern causes a readily discernable rectangular sub-pattern to be produced. The discernable sub-pattern defeats the goal of creating a region that appears to have a relatively-uniform texture. (Application, page 3, lines 15-24).

In an attempt to reduce how noticeable the sub-patterns are, some texture mapping methods alternate between using the original tile, and modified images of the tile. The modified images are typically produced by rotating, translating and/or mirroring (i.e. flipping over) the original tile in order to tile the target area. However, because periodic symmetry is inherent in these methods, discernable sub-patterns are also evident on the target areas. (Application, page 3, line 25 - page 4, line 2).

The present invention stems, at least in part, from the recognition of a need to tile a target area with a texture image without creating discernable sub-patterns. To address this need, the inventor has developed, disclosed, and claims various techniques.

For example, Claim 1 features "covering the target area in an aperiodic tiling pattern with tiles generated from said texture image." (Application, page 17, Claim 1, lines 4-5). The use of an aperiodic tiling pattern of tiles based on the texture image is fundamentally different from the traditional approaches of using periodic tiling patterns or using modified images produced by rotating, translating and/or mirroring the original tile because aperiodic tiling patterns inherently lack any translational symmetry. Therefore, a target area can be covered with relatively small tiles cut from the same texture image without producing a linear repetition in the tiling pattern. (Application, page 11, line 26 - page 12, line 4). There are several known aperiodic tiling patterns, some of which are described in a book titled "Tiling and Patterns" written by Grünbaum and Shephard and published in 1987 by Freeman and Company. (Application, page 12, lines 11-14).

FIG. 4 illustrates an example of an aperiodic tiling that can be used in accordance with an embodiment of the invention. FIG. 4 contains a target area 402, a textured image area 408 and an "aperiodic tile set" consisting of aperiodic tiles 404 and 406. An aperiodic tile set is a set of one or more tile shapes that exist in a given aperiodic tiling pattern. In this example, aperiodic tiles 404 and 406 have been mapped onto the textured image area 408 to generate textured tiles 404' and 406'. As illustrated, the tiling of target area 402 is performed by applying textured tiles 404' and 406' in an aperiodic tiling pattern to target area 402. Because the tiling pattern of

textured tiles 404' and 406' have no translational symmetry, there is no regular repetition of the tiling pattern and applying the textured tiles 404' and 406' made from the texture image 408 to the target area 402 does not produce any discernable sub-patterns.

FIG. 5 illustrates how one aperiodic tiling pattern can be used to eliminate linear repetition of the tiling pattern in a target area 502. In this example, textured tiles 404' and 406' have been made from the grass texture shown in tile 102 and applied to cover target area 502. As readily seen, the discernable rectangular sub-patterns that are visible in target area 200 have been eliminated through the use of aperiodic tiles 404 and 406.

As another example, Claim 6 features "performing a tiling substitution based on said substitution tiling level to generate said tiling." (Application, page 19, Claim 6, lines 4-5). The substitution tiling approach takes advantage of the fact that some sets of aperiodic tiles can be constructed from a collection of smaller sized tiles of the same shape. (Application, page 12, lines 5-7). FIG. 6 illustrates how the combining of smaller sized tiles of the same shape can be used to perform composition tiling. In this example, copies of tile 602 are combined to generate a composition atlas 604. A composition atlas is a description of the substitution rules that can be used to build each tile from the appropriate next set of smaller sized tiles. Thus, a composition atlas provides a description of how to get from one tiling level to the next. (Application, page 13, lines 15-22).

Composition atlases are created by combining the tiles of a particular aperiodic tile set to generate a tile that has the same shape as a tile within the aperiodic tile set. Additionally, copies of composition atlas 604 may be recursively applied to each

individual tile in the level one tiling 604 in order to generate tiling 606. (Application, page 13, lines 23-26).

VI. ISSUES

Whether Claims 1-5, 7-13 and 15-20 are patentable under 35 U.S.C. § 103(a) over *Jensen*.

Whether Claims 6 and 14 are patentable under 35 U.S.C. § 103(a) over *Jensen* as applied to Claims 1 and 8 and further in view of *Deutsch*.

VII. GROUPING OF CLAIMS

The claims should not be regarded as all standing together since the claims recite respective limitations that render each claim separately patentable. For this appeal, the following groups are recognized:

A. Independent Claims 1, 8, 15, and 17 and Dependent Claims 2, 7, 9, 13, and 16.

B. Dependent Claims 3, 10, and 18.

C. Dependent Claims 4, 5, 11, 12, 19, and 20.

D. Dependent Claims 6 and 14.

VIII. ARGUMENT

A. Independent Claims 1, 8, 15, and 17 and Dependent Claims 2, 7, 9, 13, and 16 are not obvious over *Jensen* because *Jensen* does not disclose, teach, or suggest all of the claimed limitations.

As stated in MPEP §2141.03: "To establish prima facie obviousness of a claimed invention, all the claimed limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." Claims 1, 2, 7, 8, 9, and 13 all feature "covering the target area in an **aperiodic tiling pattern** with tiles generated from said texture image." (emphasis added). Similarly, Claims 15 and 16 feature "a plurality of texture tiles generated from said texture image and arranged on said screen display in an aperiodic pattern that substantially covers said target region", and Claim 17 features "means for covering the target area in an **aperiodic tiling pattern** with tiles generated from said texture image." (emphasis added). The rejection of these claims should be reversed because *Jensen* does not disclose, teach, or suggest in any way covering a target area with texture tiles using an aperiodic tiling pattern as featured in Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17.

1) Discussion of *Jensen*

Jensen is concerned with a method for creating rotated texture tiles that can be arranged in a seamless **periodic** tiling pattern. Specifically, *Jensen* attempts to avoid the problem that occurs when (1) the pattern that covers a tile is rotated, but (2) the pattern of the tile on the target surface is not rotated. It is believed that the current rejections are

due at least in part to a confusion of these to uses of the term "pattern". To avoid such confusion, the pattern that covers a tile shall be hereafter referred to as the "face pattern", and the pattern of the tiles on the target surface shall be referred to as the "tiling pattern".

According to *Jensen*, using prior techniques, the face pattern on some tiles will not match up with the face pattern on other tiles when the face pattern is rotated without rotating the tiling pattern. (See Fig. 9 of *Jensen*). *Jensen's* goal is to construct tiles in a way that, when placed in a periodic tiling pattern, the face pattern of the tiles is both (1) rotated, and (2) matched up with the face pattern on adjacent tiles (see Fig. 14 of *Jensen*).

More specifically, FIG. 9 of *Jensen* shows the problem of the prior art that arises when tiles, arranged in a periodic tiling pattern, have a rotated face pattern. The seam between the two subtiles 800 is clearly visible because the face pattern on the surface of the left subtile does not match the face pattern on the surface of the right subtile at the boundary 904.

The actual tiles that are used to cover an area are cut from a textured tile, so rotating the textured tile has the effect of rotating the face pattern of the tiles that will be used to cover an area (see Fig. 8 of *Jensen*). *Jensen* overcomes the problem of the visible seams between tiles with a rotated face pattern by using an iterative procedure to select a rotated textured tile having a rotated face pattern that is cut from a larger, rotated supertile.

Jensen teaches taking a small, unrotated textured tile, then reproducing it to create a larger textured supertile, then rotating that textured supertile, determining one or two periods along one or two sets of axes, and using the periods to define a new small,

tile with a rotated face pattern. The new tile thus produced has (1) a rotated face pattern and (2) a specified degree of seamless tiling when repeated in a **periodic** tiling pattern. (Col. 3, lines 12-19.) Note that the new tile that is created contains the same face pattern as the original, except that the face pattern is rotated. (Col. 7, lines 13-17.) *Jensen* refers to the new tile thus created as a "rotated textured tile." Herein, the new tile produced by the approach in *Jensen* is referred to as a "textured tile with a rotated face pattern" since the tile produced is not itself rotated; rather it is the face pattern on the tile that is rotated.

As mentioned above, *Jensen* uses an unrotated textured tile to create a textured supertile and then rotates the textured supertile through an angle. (Abstract, FIG. 11 through FIG. 14). A period along each axis is selected by moving a window along each axis and comparing the pixels in the window to a reference window. (Abstract) Once a suitable match is found between the pixels in the moving window and the reference window, a period is defined for the axis as the distance between position of the reference window and the position of the moving window where the match is found. (Col. 8, lines 1-10; Col. 9, lines 20-25).

After a period is defined for each axis, the textured tile with the rotated face pattern is formed by cutting a tile from the rotated textured supertile. The resulting tile has dimensions that correspond to the period for each axis (e.g., a width equal to the X period and a height equal to the Y period). (Col. 10, lines 1-3). The textured tile with the rotated face pattern of the selected dimensions is cut from the supertile at the position corresponding to the window positions that are used to define the periods for each axis. (Col. 10, lines 3-5).

The selection of a particular pattern for the surface of the final textured tile with the rotated face pattern is how *Jensen* overcomes the problem of visible seems between tiles with rotated face patterns that are arranged in a periodic tiling pattern to cover an area. Thus, when the final textured tile with the rotated face pattern is arranged in a periodic tiling pattern, the resulting face pattern on the tiles is the same as the face pattern of the rotated supertile shown in FIG. 14.

2) Response to the Rejection of the Final Office Action

In stark contrast to *Jensen*, independent Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17 feature ***aperiodic*** tiling patterns. As discussed on pages 10 and 11 in the present application, aperiodic tiling patterns inherently lack translational symmetry and therefore can be used to cover a target area without forming a linear repetition of the tiling pattern.

The method of *Jensen* will still leave linear repetitions in the tiling pattern that can be readily apparent to an observer when the face pattern includes certain types of textures, such as grass. The linear repetitions occur in *Jensen* both when repeating the original tile to create the supertile and in applying the rotated textured tile to a surface. In contrast, the aperiodic tiling approach featured in Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17 provides for tiling a target area with a texture image, such as that shown in FIG. 5 of the present application, without creating, within the tiling pattern, the type of linear repetitions (e.g., discernable sub-patterns) evident in FIG. 2B of the present application.

Please note that *Jensen* does not address the problem of removing linear repetitions among the tiling pattern itself, such as can be observed in FIG. 2A of the

present application. By arranging the tiles in an ***aperiodic*** manner as required by the claims of the present application (not the ***periodic*** manner of *Jensen*), those linear repetitions of the tiles are no longer observable, as can be seen in FIG. 5 of the present application.

Regarding Claim 1, the Final Office Action states that *Jensen* discloses "covering a target area in an aperiodic tiling pattern (col. 6, ll. 6, ll. 37-46; col. 7, ll. 4-15)." However, the portion of *Jensen* cited describes a tiling pattern that is ***periodic*** instead of ***aperiodic*** (e.g., not periodic; irregular; without periodicity). For example, *Jensen* states: "A supertile ... may be readily produced by stamping out repeated adjacent copies of the tile" (Col. 6, lines 38-42.) The placement of repeated adjacent copies of a pattern to produce a new pattern produces a linear repetition in the tiling pattern, and thus the new tiling pattern is periodic. Further, any tiling pattern with linear repetition will remain periodic (e.g. containing linear repetition), irrespective of how the face pattern is rotated.

While *Jensen* discloses "a period", this does not relate to the aperiodic tiling patterns required by the claims of the present application. In *Jensen*, a "period" refers to the distance along the specified X- or Y-axis after which the portion of the supertile begins to repeat. (Col. 6, lines 59-64.) This indicates that *Jensen* is making periodic tiling patterns, not aperiodic tiling patterns. *Jensen* does not disclose, teach or suggest the use of aperiodic tiling patterns for covering a target area as featured in Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17.

3) Discussion of the Examiner's "Response to Arguments"

The Examiner's "Response to Arguments" in the Final Office Action states that in respect to Claims 1, 8, and 15, *Jensen* is interpreted

> "as disclosing aperiodic tiling patterns because he translates and/or rotates a portion of a supertile, allows successive selection of periods, which identifies an aperiodic tile repetition, along either or both of the X and Y axes and modifies the size and orientation of the tile displayed at the selected period (col. 6, ll. 59-65; col. 7, ll. 4-6, 9-11, 27-32)."

It is respectfully submitted that a careful reading of *Jensen* shows that this is an incorrect characterization of the disclosure of *Jensen*.

Jensen discloses neither a "successive selection of periods" nor "an aperiodic tiling pattern through manipulation of the period of repetition." This characterization in the Final Office Action appears to mistake (1) the method by which a period along each axis is determined with (2) how tiles are repeated in a tiling pattern according to the period thus determined. As discussed above, to identify the period for the axis, *Jensen* uses an iterative procedure using a window of pixels that is successively moved along an axis. Once a match between the pixels in the window and a set of pixels at a reference position is found, the period is set based on the distance in pixels along the axis between the best fit window position and the reference position. (Col. 8, lines 1-10 and FIG. 16 through FIG. 19.) Once the period for each axis is determined in this manner, the textured tile with the rotated face pattern is set to be a rectangle of dimension X-period by Y-period cut from the rotated supertile at coordinates of the window positions giving rise to the period selected for each axis. (Col. 9, line 67 - Col. 10, line 5.)

Neither the portions of *Jensen* cited in the "Response to Arguments" of the Final Office Action, nor any other portion of *Jensen*, support the Final Office Action's characterizations of "successive selection of periods" or "an aperiodic tiling pattern through manipulation of the period of repetition." Each of cited portion of *Jensen* is addressed below.

Col. 6, lines 59-65 states:

> "Returning to FIG. 11, an X-period and a Y-period are selected during a selecting step 1106. The X-period represents the distance along the X-axis in FIG. 14 after which values of the necessary portion of the rotated supertile 1400 begin to repeat; the Y-period represents a similar distance along the Y-axis. In general, the periods are not exact, in that the repetition of pixel values may be approximate." (emphasis added).

This passage clearly states that one X-period is selected and that the X-period is used to determine how much of the rotated supertile along the X-axis is repeated (e.g., tiled in a periodic patter), and likewise that one Y-period is selected for the Y-axis. As discussed above, the textured tile with the rotated face pattern is defined by the X-period and the Y-period. (Col. 10, lines 1-10.) Nothing in this cited passage of *Jensen* discloses, teaches, or suggests either a "successive selection of periods" or "an aperiodic tiling pattern through manipulation of the period of repetition" as stated in the Final Office Action.

Col. 7, lines 4-6, 9-11, and 27-32 state:

> "During a producing step 1108, a rotated textured tile is generated using the X-period, the Y-period, and a portion of the rotated supertile 1400...Like the unrotated tile 1200, the rotated textured tile tends to be much smaller than large screen regions such as the desktop...In many cases, a period will be selected along each of two independent axes, and the rotated texture tile produced by the invention will be smaller in both directions than the desktop or other display

region. However, the invention may also be used to select a period along only one axis."

Again, this passage refers to only one X-period and one Y-period. The passage describes a textured tile with the rotated face pattern based on the X-period, the Y-period, and a portion of the rotated supertile, which as discussed above, results in a rectangular textured tile that has dimensions of X-period and Y-period and the portion of the rotated supertile 1400 defined by the window position used to define the X-period and Y-period. (*See* Col. 10, lines 1-5.) Nothing in this cited passage of *Jensen* discloses, teaches, or suggests either a "successive selection of periods" or "an aperiodic tiling pattern through manipulation of the period of repetition" as stated in the Final Office Action. Therefore, *Jensen* does not disclose, teach, or suggest an "aperiodic" tiling pattern as featured in the claims.

In addition, the Final Office Action appears to be equating "aperiodic tile repetition" with translation and/or rotations of a supertile, selection of a period on more than one axis, and modification of "the size and orientation of a tile displayed/placed at the selected period." However, as explained in detail below, none of these features of *Jensen* relates to an aperiodic tiling pattern as required by the claims of the application.

The translation and rotation of the supertile in *Jensen* is one step in selecting the period for each axis to define the textured tile with the rotated face pattern that, when repeated in periodic pattern, will be seamless (or at least seamless to the degree corresponding to the specified tolerances). (Col. 10, lines 11-14.) Such translation and rotation in *Jensen* does not disclose, teach, or suggest an "aperiodic" tiling pattern as required by each claim of the application.

In *Jensen*, the selection of a period on more than one axis is used to define the bounds of the textured tile with the rotated face pattern in the same dimensions defined by the axes. (Col. 10, lines 1-10.) For example, a two-dimensional rotated textured tile is defined by two dimensions, which in *Jensen* are the X-period and the Y-period. When the textured tile with the rotated face pattern is used to tile a larger two-dimensional display area, the tile is repeated in a periodic fashion in both the X and Y directions, and if the tile is rectangular, the period in each direction is different. However, the use of a different period along more than one axis as in *Jensen* does not disclose, teach, or suggest an "aperiodic" tiling pattern as required by each claim of the application.

In *Jensen*, the size of a textured tile with the rotated face pattern is defined by the X-period and Y-period. (*See* Col. 10, lines 1-9.) The textured tile with the rotated face pattern is based on the rotation of the supertile from an initial angle theta (θ) through an angle delta (Δ). (Col. 6, lines 29-30, 48-50.) Both the setting of the size of the tile and the rotation of the tile are used to define the textured tile with the rotated face pattern that will have the specified degree of seamless tiling (e.g., that the seams between repetitions of the rotated textured tile will not be observable). (Col. 3, lines 16-20.) However, *Jensen* does not discuss any manipulation or modification of the rotated textured tile's size and rotation once established. Thus, *Jensen* does not disclose, teach or suggest modification or manipulation "the size and orientation of a tile displayed/placed at the selected period" as stated in the Final Office Action. Further, the setting of the size and orientation of the textured tile with the rotated face pattern as in

Jensen does not disclose, teach, or suggest an "aperiodic" tiling pattern as featured in the claims.

4) Correcting the Examiner's Misunderstanding

During the Examiner interview on March 28, 2001, the Appellants explained that *Jensen* is concerned with ***selecting*** **the patterns *on* the surface of tiles**, while the present invention is concerned with **the *placement* of patterns *of* tiles on a surface**. More specifically, *Jensen* is concerned with finding out how far to rotate the face pattern of a tile in order for the pattern on the surface of the rotated tile to align with the pattern on the surface of an adjacent tile. On the other hand, the present invention is concerned with placing textured tiles on a surface, and the use of aperiodic tiling patterns to reduce a viewer's ability to detect any pattern in the texture covering the surface.

During the Interview, the Appellants also explained that even if one were to generate a series of rotated tiles, where each tile (not just the face pattern) was rotated slightly more than its predecessor, it is not clear how such a series of tiles could be used to cover a surface (how rotated tiles could be placed adjacent to each other), unless, for example, the tiles themselves were not rotated, but only the face pattern of the tiles was rotated. For example, FIG. 9 of *Jensen* shows two adjacent square tiles that have not been rotated, where the face pattern of the square tiles has been rotated. A surface can easily be covered by square tiles, such as those shown in FIG. 9. However, the tiling pattern of the tiles on such a surface would be a symmetrical, checkerboard pattern (a far cry from the "aperiodic" pattern required by the present claims).

Because the claims of the application are concerned with covering a desired area in an aperiodic tiling pattern with tiles that are generated from a textured image, the specific details about the face pattern of the tiles, including whether or not the face pattern is rotated or how the face pattern is selected, is not pertinent to the claims in the application. Instead, the claims of the present application feature covering a target area by arranging tiles (which are generated from a texture image) in an aperiodic tiling pattern so that visible patterns are eliminated. In contrast, the disclosure of *Jensen* is directed to an approach for selecting a rotated face pattern for a tile so that when the tile is arranged in a periodic tiling pattern there are no visible seams between the tiles due to discontinuities in the face patterns on the surfaces of the tiles.

If the rotated textured tile of *Jensen* were to be arranged in an aperiodic pattern, the seams between the tiles would be visible. Discontinuities between the face patterns on the surfaces of adjacent tiles would appear because *Jensen* compares the sliding window to a reference window to find a match between the face patterns shown in the two windows. The point at which the two windows have matching face patterns defines where the face pattern along an axis repeats. In other words, the approach of *Jensen* is successful in eliminating visible seams between tiles because the face pattern selected for the surface of the final textured tile with the rotated face pattern is periodic. If the face pattern selected for the surface of the final rotated texture tile were not periodic, the discontinuities would appear between adjacent tiles.

Even if the disclosure of *Jensen* were understood to suggest the use of different tiles having different sizes and orientations to cover an area, the seams between the tiles would again be visible due to discontinuities in the face patterns on the surfaces of the

tiles. The discontinuities would arise because the different tiles would be cut from different portions of the rotated supertile, and there would be nothing to ensure that the face patterns at the boundaries of such different tiles would match. The discontinuities would also arise between tiles of the same size but with different orientations because the face pattern on the tiles would not be oriented in the same direction.

Furthermore, the use of different tiles with different sizes and shapes would lead to problems in how to cover an area because there is nothing to ensure that the differing tiles would properly fit together to cover the area. In contrast, as shown in FIG. 4 of the application, the aperiodic tiles 404 and 406 and the aperiodic pattern of arranging textured tiles 404' and 406' are defined such that the tiles fit together to cover the target area 402.

In summary, the claims present application feature ***covering a target area according to an aperiodic tiling pattern with tiles*** generated from a texture image, so that visible patterns are eliminated. In contrast, *Jensen* discloses an approach for ***selecting a rotated pattern for the surface of a tile*** so that when the tile is repeated in a periodic pattern, seams between the tiles are not visible. Therefore, the Appellants respectfully submit that the prior art does not disclose, teach, suggest, or render obvious the covering a target area by arranging tiles in an aperiodic pattern, as required by Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17.

5) The Examiner Returns to Her Original Misunderstanding

The Appellants have taken great time and effort over many months to educate the Examiner on the specifics of the technology of the invention and the prior art

through responses to two office actions, the Interview conducted on March 29, 2001, and the Request for Reconsideration filed after the Interview. In the two office actions, the Examiner initially appeared to be confusing the rotated face pattern on the tiles disclosed in *Jensen* with the rotation and placement of tiles according to an aperiodic tiling pattern, as claimed in the application. For example, in the "Response to Arguments" portion of the Final Office Action, the Examiner stated that she "interprets *Jensen* as disclosing aperiodic tiling patterns because he translates and/or rotates a portion of a supertile, allows successive selection of periods, which identifies an aperiodic tile repetition, along either or both of the X and Y axes and modifies the size and orientation of the tile displayed at the selected period."

However, during the Interview, the Appellants appeared to be successful in conveying to the Examiner the fundamental distinction that *Jensen* merely disclosed how to generate a rotated face pattern for a tile so that seams would not appear when the tile was repeated in a periodic pattern, whereas the Appellants place textured tiles according to an aperiodic tiling pattern. Further, the Appellants pointed out in the Interview that the Application on page 11 referred to "several known aperiodic tiling patterns, some of which are described in a book titled 'Tiling and Patterns' written by Grünbaum and Shephard and published in 1987 by Freeman and Company." The Examiner then appeared to understand that the invention as claimed was to covering a target area with textured tiles placed in an aperiodic tiling pattern, and that the invention was not the creation or discovery of aperiodic tiling patterns themselves.

Furthermore, at the end of the Interview, the Examiner appeared to understand and acknowledge the differences between the invention as claimed and the disclosure of

the prior art reference, *Jensen*. Specifically, the Examiner stated at the end of the Interview that she would do more research on aperiodic tiling patterns and would most likely perform another search. Further, the Interview Summary mailed April 9, 2001, evidences the Examiner's understanding that the prior art did not disclose the invention by stating:

> "Jensen discloses manipulating the patterns on tiles to identify matching seams, while the Appellants manipulate placement of tiles on a textured surface."

Thus, as a result of the Interview, the Examiner finally appeared to appreciate the fundamental difference between *Jensen's* approach to selecting a rotated face pattern for use on the surface of tiles arranged in a periodic tiling pattern and the Appellants' placement of textured tiles according to an aperiodic tiling pattern.

In addition, the Examiner informed the Appellants in a telephone call on May 8, 2001 that she had in fact performed another search on April 11, 2001, less than two weeks following the Interview and just two days following the mailing of the Interview Summary. Apparently that search failed to reveal any pertinent prior art because the Examiner did not issue another action. Furthermore, the Examiner later said in a call with the Appellants on June 12, 2001 that she had not saved the results of the search performed on April 11, 2000. Had the Examiner identified pertinent art in the search, there would have been no reason for the Examiner to not cite such art in another action. The fact that the Examiner both failed to issue another action and did not save the results of the search indicates that the search failed to identify any art pertinent to the Appellants' invention as understood by the Examiner after the Interview.

Apparently as a result of the more than two month delay between the Interview and the most recent Advisory Action, the Examiner's recollection and understanding of the invention and prior art has faded to the point at which the Examiner could only recall her original misunderstanding of the prior art. The Examiner's most recent Advisory Action, mailed June 19, 2001, evidences this misunderstanding by stating:

> "the cited art discloses controlling the repetition of patterns on tiles on a surface, which creates the appearance of an aperiodic placement of tiles on a surface."

Thus, the Examiner, while not maintaining that *Jensen* discloses an aperiodic tiling pattern, believes that *manipulating patterns **on** tiles* looks like *an aperiodic arrangement **of** tiles*, despite the fundamental difference between the two ideas, which the Examiner recognized in the Interview Summary. As a result of not receiving another action in the case following the Interview, the Appellants were forced to file this appeal prior to expiration on June 20, 2001 of the six-month statutory period following the mailing of the Final Office Action on December 20, 2000.

For the reasons stated above, Appellants respectfully submit to the Honorable Board that the Examiner has not established that Jensen discloses, teaches, or suggests all of the claimed limitations of Claims 1, 2, 7, 8, 9, 13, 15, 16, and 17.

B. Dependent Claims 3, 10, and 18 are not obvious over *Jensen* because *Jensen* does not disclose, teach, or suggest all of the claimed limitations.

Claims 3 and 10 feature "**generating a set of textured tiles** based on said **aperiodic** tiling pattern." (emphasis added). The Appellants respectfully submit that

Jensen does not disclose, teach, or suggest the feature of generating textured tiles based on an aperiodic tiling pattern.

Regarding Claims 3, 10, and 18, the Final Office Action states that *Jensen* discloses "selecting an aperiodic tiling pattern (col. 6, ll. 40-46; col. 7, ll. 33-34), generating a set of tiles (col. 6, ll. 37-51), applying the tiles to the target area (FIG. 14; col. 7-8, ll. 55-10)." However, the portions of *Jensen* cited describe a tiling pattern that is ***periodic***, not ***aperiodic***. Furthermore, the cited portions of *Jensen* do not relate in any way to generating a set of textured tiles based on any type of tiling pattern, regardless of whether or not the tiling pattern is aperiodic.

For example, *Jensen* states that "the user may wish to stamp out a single row (or column) of long narrow tiles...", (Col. 6, lines 32-34), wherein the use of the phrase "to stamp out" indicates a periodic pattern, not an aperiodic pattern. Similarly, *Jensen* also states the tile "may be readily produced by stamping out repeated adjacent copies..." (Col. 6, lines 41-42), and that "the user may wish to stamp out a single row (or column) of long narrow tiles, making seamlessness an issue in only one direction" (Col. 7, lines 32-34), both of which indicate a periodic repetition of the tiles, not aperiodic, because the tiles are being "stamped" out.

For the reasons stated above, Appellants respectfully submit to the Honorable Board that the Examiner has not established that Jensen discloses, teaches, or suggests all of the claimed limitations of Claims 3, 10, and 18.

C. Dependent Claims 4, 5, 11, 12, 19, and 20 are not obvious over *Jensen* because *Jensen* does not disclose, teach, or suggest all of the claimed limitations.

Claims 4, 5, 11, 12, 19, and 20 feature "covering the target area with one or more **aperiodic tiles**, wherein the one or more aperiodic tiles are based on the **aperiodic tiling pattern**; and **mapping a corresponding textured tile to each of the one or more aperiodic tiles**." (emphasis added). The Appellants respectfully submit that *Jensen* does not disclose, teach, or suggest the features of covering a target area with aperiodic tiles from an aperiodic tiling pattern and mapping textured tiles to the aperiodic tiles.

Regarding Claims 4, 11, and 19, the Final Office Action states that *Jensen* discloses "mapping tiles to the aperiodic tiles (col. 7-8, ll. 55-10)." Regarding Claims 5, 12, and 20, the Office Action states that *Jensen* discloses a "tiling associated with tiles based on the aperiodic tiling pattern (col. 6-7, ll. 59-9)." However, the portions of *Jensen* cited describe a tiling pattern that is ***periodic***, not ***aperiodic***, and how the periods are selected for defining the rotated texture tile that, when repeated in a periodic tiling pattern, provides the specified degree of seamlessness.

Jensen describes the selection of the period along each axis as the distance along each axis "after which the values of the necessary portion of the rotated supertile 1400 begin to repeat." (Col. 6, lines 59-64.) "[A] rotated textured tile is generated using the X-period, Y-period, and a portion of the rotated supertile 1400", and the textured tile with the rotated face pattern is "aligned at a rotation of theta units to facilitate stamping" and to permit "seamless tiling." (Col. 7, lines 4-12.) *Jensen* describes the selection of "a period for each axis" by moving a window to successive positions until the desired

degree of seamless is obtained. (Col. 7, line 66 - Col. 8, line 10.) These portions of *Jensen* describe how the textured tile with the rotated face pattern is generated and the use of the textured tile with the rotated face pattern for periodic tiling to avoid the appearance of seams. There is nothing in either the cited passages from the Office Action or any other part of *Jensen* that describes, teaches, or suggests an aperiodic tiling system as featured in the claims, little less the mapping of textured tiles to aperiodic tiles.

The "Response to Arguments" of the Final Office Action states that in respect to Claims 4, 5, 11, and 12, *Jensen* is interpreted "as disclosing mapping textured tiles to the aperiodic tiles because he teaches applying computer graphics operations to each tile placed at the selected period." As discussed above, *Jensen* does not disclose, teach or suggest aperiodic tiles or aperiodic tiling. Further, the graphic manipulations disclosed in *Jensen* are for the generation of the supertile based on periodic repetitions of the original tile 1200 and subsequent rotation of the supertile. (Col. 6, lines 38-51.) *Jensen* discusses that only the portions of the supertile and rotated supertile that lie on the X-axis and Y-axis need to be calculated. (Col. 6, lines 52-58.) As discussed above, the supertile and rotated supertile are used as the starting point for the selection of the period for each axis, which in turn is used to define the final result, the textured tile with rotated face pattern. (Col. 3, lines 16-19.)

In contrast, Claims 4, 5, 11, 12, 19, and 20 feature a mapping of textured tiles to aperiodic tiles that are based on an aperiodic tiling pattern. Thus, these Claims feature two sets of tiles and a mapping that relates the tiles of one set (the textured tiles) to the tiles of the other set (the aperiodic tiles). For example, as discussed on page 15 of the

application, FIG. 9B and FIG. 9C are used to illustrate how textured tiles are mapped to aperiodic tiles. However, in *Jensen* there is no mapping between two sets of tiles, much less a mapping between textured tiles and aperiodic tiles. Further, the Appellants respectfully disagree with the Examiner's assertion in the Final Office Action that "applying computer graphics operations to each tile" is a mapping. A mapping defines a relationship between objects and is not the performance of graphical operations on objects. Therefore, *Jensen* does not disclose, teach, or suggest a mapping between textured tiles to aperiodic tiles as feature in Claims 4, 5, 11, 12, 19, and 20.

For the reasons stated above, Appellants respectfully submit to the Honorable Board that the Examiner has not established that Jensen discloses, teaches, or suggests all of the claimed limitations of Claims 4, 5, 11, 12, 19, and 20.

D. Dependent Claims 6 and 14 are not obvious over *Jensen* as applied to Claims 1 and 8 and further in view of *Deutsch* because neither Jensen nor Deutsch, either alone or in combination, disclose, teach, or suggest all of the claimed limitations.

Claims 6 and 14 feature "determining a **substitution tiling level**; and performing a **tiling substitution** based on said **substitution level tiling** level to generate said tiling." (emphasis added). The Appellants respectfully submit that *Jensen* does not disclose, teach, or suggest the features of determining a substitution tiling level to be used to perform a tiling substitution.

Substitution tiling, or composition tiling, is a technique in which tiles are constructed from a collection of smaller sized tiles of the same shape. FIG. 6 illustrates

how the combining of smaller sized tiles of the same shape can be used to perform composition tiling. In this example, copies of tile 602 are combined to generate a composition atlas 604. A composition atlas is a description of the substitution rules that can be used to build each tile from the appropriate next set of smaller sized tiles. Thus, a composition atlas provides a description of how to get from one tiling level to the next. (Application, page 13, lines 15-22).

Composition atlases are created by combining the tiles of a particular aperiodic tile set to generate a tile which has the same shape as a tile within the aperiodic tile set. Additionally, copies of composition atlas 604 may be recursively applied to each individual tile in the level one tiling 604 in order to generate tiling 606. FIG. 7 illustrates an example of two aperiodic tilings and their corresponding composition atlases. For each composition atlas, the size of the tiles change, but the actual shape remains the same. (Application, page 13, line 23 - page 14, line 3).

Textured images, typically stored as a file, are composed of a plurality of texels that are arranged in a particular order. For example, textured image 102 is composed of a plurality of texels which are arranged in a rectangular array that has a certain height and width. In addition to the textured images, a target area, such as a computer monitor, consists of a plurality of pixels that are arranged in a particular order. For example, target area 502 is composed of a plurality of pixels which are arranged in a rectangular array that has a certain height and width. Each pixel is represented on the monitor by one or more bits. (Application, page 15, lines 1-15).

To apply a textured image to a target area, texels from the textured image are mapped into pixels within the target area on a pixel by pixel basis. In certain cases,

each texel in the textured image may map directly to a pixel within the target area. In other cases, multiple texels may be map to a single pixel or instead, a single texel may be mapped to multiple pixels. The mapping of texels in a textured image to pixels in a target image is well known in the art of computer graphics as several books and articles have been published that discuss this area of computer graphics. For example, a book titled "Computer Graphics: Principles & Practice, 2nd Ed. in C" written by Foley, van Dam, Feiner & Hughes, and published in 1996 by Addison-Wesley, describes the process of mapping of texels in a textured image to pixels in a target image. (Application, page 15, lines 16-25). FIG. 8 is a flow diagram that illustrates a method for tiling a texture image using a composition atlas.

Regarding Claims 6 and 14, the Final Office Action states that "Deutsch discloses determining a substitution tiling level and using the substitution tiling level to generate the tiling (abstract; col. 6, ll. 20-31), which Jensen fails to disclose." However, *Deutsch* lacks any mention or suggestion of substitution tiling levels. *Deutsch* is directed toward a technique for developing an analytical model of an image based upon a pixel map. (Col. 2, lines 24-26). The approach of *Deutsch* addresses the problem of representing sampled, or scanned, images in a condensed form that is amenable to scaling, rotating, clipping, windowing, and other manipulations. (Col. 1, lines 57-61).

The "tiles" referred to in *Deutsch* are merely sub-areas of the larger pixel image (Col. 2, lines 39-41; Col. 6, lines 30-31). *Deutsch* describes a hierarchical approach to developing an analytical model of an image based on the pixel map from an image-sampling device such as a scanner. (Col. 2, lines 24-27). The cited portions of *Deutsch* describe how to represent an image via a data structure having a

two-dimensional array of "supertiles." Each of the supertiles encompass one or more "tiles" that further represent sub-areas of the source image. (Col. 6, lines 21-31).

Thus, the cited portions of *Deutsch* do not relate to using tiles in a tiling pattern to cover a surface; rather, *Deutsch* breaks down a scanned image into different levels of "tiles." In contrast, the substitution tiling approach featured in Claims 6 and 14 involve combining smaller sized tiles of the same shape to make larger tiles, as depicted in FIGS. 6 and 7. The substitution tiling approach of making larger tiles from smaller tiles of the same shape is fundamentally different than the approach of *Deutsch* in which a scanned image is broken down into different levels of "tiles" to represent and manipulate the image.

The "Response to Arguments" of the Final Office Action states that in respect to Claims 6 and 14, *Jensen* "teaches selecting a period indicating non-linear points of repetition of a supertile." The Appellants respectfully submit that careful reading of *Jensen* shows that this characterization is inaccurate. First, *Jensen* discloses a tile 1200 that is periodically repeated along the axes to produce a supertile 1300. (Col. 6, lines 38-46.) Thus, it is the tile 1200, not the supertile 1300, which is repeated. Second, nothing in *Jensen* discloses, teaches, or suggests "non-linear" repetition of a tile, a supertile, or anything else. Third, the use of a period inherently imparts linearity to the tile being repeated, and thus a period cannot indicate "non-linear points of repetition" as stated in the Final Office Action. Therefore, contrary to the Examiner's assertions, *Jensen* does not disclose, teach, or suggest an "aperiodic" tiling pattern.

For the reasons stated above, Appellants respectfully submit to the Honorable Board that the Examiner has not established that *Jensen* and *Deutsch*, either alone or in

combination, disclose, teach, or suggest all of the claimed limitations of Claims 6 and 14.

IX. CONCLUSION AND PRAYER FOR RELIEF

The rejections under 35 U.S.C. § 103(a) lack the requisite factual and legal basis. The applied references, *Jensen* and *Deutsch*, do not suggest numerous claimed limitations. Appellants respectfully submit that the imposed rejections under 35 U.S.C. § 103(a) are **not** viable and respectfully solicit the Honorable Board to **reverse** each of the imposed rejections under 35 U.S.C. § 103(a).

Respectfully submitted,
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on 8-20-01 by

X. APPENDIX

1. A method for performing textured mapping of a target area, the method comprising the steps of:
receiving input that defines a texture image; and
covering the target area in an aperiodic tiling pattern with tiles generated from said texture image.

2. The method of Claim 1, wherein the step of receiving input that defines the texture image includes the step of scanning one or more texture images into memory.

3. The method of Claim 1, wherein the step of covering the target area includes the steps of:
selecting an aperiodic tiling pattern;
generating a set of textured tiles based on said aperiodic tiling pattern; and
applying the textured tiles to the target area.

4. The method of Claim 3, wherein the step of applying the textured aperiodic tiles to the target area includes the steps of:
covering the target area with one or more aperiodic tiles, wherein the one or more aperiodic tiles are based on the aperiodic tiling pattern; and
mapping a corresponding textured tile to each of the one or more aperiodic tiles.

5. The method of Claim 3, wherein the step of applying the textured tiles to the target area includes the steps of:

generating a tiling, wherein the tiling is associated with tiles based on said aperiodic tiling pattern;

covering the target area with said tiling; and

mapping the textured tiles to the tiles associated with said tiling.

6. The method of Claim 5, wherein the step of generating the tiling includes the steps of:

determining a substitution tiling level; and

performing a tiling substitution based on said substitution tiling level to generate said tiling.

7. The method of Claim 1, wherein the step of receiving input that defines the texture image includes the step of generating the texture image using a computer aided drawing program.

8. A computer-readable medium carrying one or more sequences of instructions for performing textured mapping of a target area, wherein execution of the one or more sequences of instructions by one or more processors causes the one or more processors to perform the steps of:

receiving input that defines a texture image; and

covering the target area in an aperiodic tiling pattern with tiles generated from said texture image.

9. The computer-readable medium of Claim 8, wherein the step of receiving input that defines the texture image includes the step of scanning one or more texture images into memory.

10. The computer-readable medium of Claim 8, wherein the step of covering the target area includes the steps of:
selecting an aperiodic tiling pattern;
generating a set of textured tiles based on said aperiodic tiling pattern; and
applying the textured tiles to the target area.

11. The computer-readable medium of Claim 10, wherein the step of applying the textured aperiodic tiles to the target area includes the steps of:
covering the target area with one or more aperiodic tiles, wherein the one or more aperiodic tiles are based on the aperiodic tiling pattern; and
mapping a corresponding textured tile to each of the one or more aperiodic tiles.

12. The computer-readable medium of Claim 10, wherein the step of applying the textured tiles to the target area includes the steps of:
generating a tiling, wherein the tiling is associated with tiles based on said aperiodic tiling pattern;
covering the target area with said tiling; and
mapping the textured tiles to the tiles associated with the tiling.

13. The computer-readable medium of Claim 8, wherein the step of receiving input that defines the texture image includes the step of generating the texture image using a computer aided drawing program.

14. The computer-readable medium of Claim 12, wherein the step of generating the tiling includes the steps of:
determining a substitution tiling level; and
performing a tiling substitution based on said substitution tiling level to generate said tiling.

15. A system for performing textured mapping of a target area, the system comprising:
a display screen;
a target area on said display screen;
memory storing a textured image; and
a plurality of texture tiles generated from said texture image and arranged on said screen display in an aperiodic pattern that substantially covers said target region.

16. The system of Claim 15, further comprising:
means for selecting said aperiodic pattern

17. An apparatus for performing textured mapping of a target area, the apparatus comprising:

means for receiving input that defines a texture image; and

means for covering the target area in an aperiodic tiling pattern with tiles generated from said texture image.

18. The apparatus of claim 17, wherein said means for covering the target area includes:

means for selecting said aperiodic tiling pattern;

means for generating a set of textured tiles based on said aperiodic tiling pattern; and

means for applying the textured tiles to the target area.

19. The apparatus of claim 18, wherein said means for applying the textured tiles to the target area includes:

means for covering the target area with one or more aperiodic tiles, wherein the one or more aperiodic tiles are based on the aperiodic tiling pattern; and

means for mapping a corresponding textured tile to each of the one or more aperiodic tiles.

20. The apparatus of claim 18, wherein said means for applying the textured tiles to the target area includes:

means for generating a tiling, wherein the tiling is associated with tiles based on said aperiodic tiling pattern

means for covering the target area with said tiling; and

means for mapping the textured tiles to the tiles associated with said tiling.

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FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision,
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See 37 C.F.R. §§ 1.27 AND 1.28

TOTAL AMOUNT OF PAYMENT	($) 310.00

Complete if Known	
Application Number	09/183,621
Filing Date	October 30, 1998
First Named Inventor	Martin Livesey
Examiner Name	Chante' Harrison
Group/Art Unit	2672
Attorney Docket No.	49658-0025

METHOD OF PAYMENT (check one)

1. [X] Throughout the pendency of this application, please charge any additional fees, including any required extension of time fees, and credit all overpayments to deposit account 50-1302. A duplicate of this sheet is enclosed.

Deposit Account Number: 50-1302

Deposit Account Name: Hickman Palermo Truong & Becker, LLP

2. [X] Payment Enclosed:
[X] Check [ ] Money Order [ ] Other

3. [ ] Applicant(s) is entitled to small entity status. See 37 CFR 1.27

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 0.00

2. EXTRA CLAIM FEES

		Extra Claims	Fee from Below	Fee Paid
Total Claims	-20**=		x 18.00 =	
Independent Claims	- 3**=		x 80.00 =	
Multiple Dependent			=	

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple dependent claim, if not paid
109	80	209	40	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee §	Small Entity Fee Code	Small Entity Fee §	Fee Description	Fee Paid
105	130	205	65	Surcharge – late filing fee or oath	
127	50	227	25	Surcharge – late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	390	216	195	Extension for reply within second month	
117	890	217	445	Extension for reply within third month	
118	1,390	218	695	Extension for reply within fourth month	
128	1,890	228	945	Extension for reply within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	310.00
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive – unavoidable	
141	1,210	241	605	Petition to revive – unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	690	246	345	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	690	249	345	For each additional invention to be examined (37 CFR § 1.129(b))	

Other fee (specify) _____

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid SUBTOTAL (3) ($) 310.00

SUBMITTED BY				Complete (if applicable)	
Name (Print/Type)	Craig G. Holmes	Registration No. (Attorney/Agent)	44,770	Telephone	(408) 414-1080
Signature				Date	August 20, 2001

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Docket No. 49658-0025

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